

To: The Secretary of the Interior

Date: January 25, 1999

From: The National Satellite Land Remote Sensing Data Archive Advisory Committee

Re: National Satellite Land Remote Sensing Data Archive Policy White Paper

I. Goals and Objectives

The National Satellite Land Remote Sensing Data Archive (Archive) is an important national resource. It is essential to clarify the Archive's data, information, access and delivery policies. Since ambiguous, sometimes inconsistent, terms and definitions are used, this white paper recommends and provides basic terms of reference. These can be useful in implementing the Archive's mission, specifically pertaining to access and delivery of archived data. This paper also recommends long term strategies for evolving the Archive's relationship with the private sector.

II. Introduction

The laws and policies that authorize the Archive and its activities are the basis for this white paper.¹ As relevant background, the complex environment in which the Archive operates is noted. It includes regulations that will evolve over time and archiving activities that are undergoing changes in scope, definition and practice due to rapidly changing remote sensing

¹ Some of the sources considered were:
The Land Remote Sensing Policy Act of 1992
The U.N. Principles on Remote Sensing
OMB Circulars A-76 and A-130
The Bromley Principles
The National Space Policy, National Science and Technology Council, Sept. 19, 1996
Presidential Decision Directive/NSTC-3, Landsat Remote Sensing Strategy, White House Office of the Press Secretary, May 10, 1994
Release of Imagery Acquired by Space-Based National Intelligence Reconnaissance Systems, E. O. 12951, Feb. 22, 1995
Foreign Access To Remote Sensing Space Capabilities, White House Press Release Fact Sheet, Mar. 10, 1994
31 U.S.C. 97 Fees and Charges for Government Services and Things of Value

technologies and the public's access to networked information. The remote sensing private sector is also growing in capabilities and products.

Short and long term Archive needs play a part in framing this white paper. Practical, near term administrative needs are addressed through the recommended terms of reference. The long term is addressed through strategies for evolving relationships with the private sector.

III. The Archive Is An Inherently Governmental Function

Based on its review of relevant authorities, the Committee concludes that the Archive's access and archiving activities are compatible with pertinent sections of the Land Remote Sensing Policy Act (Policy Act), the National Space Policy, and OMB Circulars A-76 and A-130.

Congress found that it “is in the best interest of the United States to maintain a permanent, comprehensive Government archive of global Landsat and other land remote sensing data for long-term monitoring and study of the changing global environment”² and authorized the establishment of the Archive.³ Congress gave the Secretary of the Interior responsibility for providing for long-term storage, maintenance, and upgrading of a basic, global, land remote sensing data set and providing timely access to it.⁴

² 15 USC 5601 (16), The Land Remote Sensing Policy Act of 1992.

³ 15 USC 5652

⁴ 15 USC 5652 (b).

National Space Policy declares that the "United States requires a continuing capability for space-based Earth observation to provide information useful for protecting public health, safety, and national security. Such a capability contributes to economic growth and stimulates educational, scientific and technological advancement."⁵ Therefore, it is mandated that "the U.S. Government will...produce and archive long-term environmental data sets."⁶ To that end, the National Space Policy directs the " Department of the Interior, through the U.S. Geological Survey (USGS), [to] maintain a national archive of land remote sensing data and other surface data as appropriate, making such data available to U.S. Government and other users."⁷

To serve the public interest, both the Legislative and Executive Branches authorized Archive development at the highest levels of law and policy making. The Archive has been directed to provide services beyond those traditionally associated with an archive. In addition to ensuring long term preservation of land remote sensing data, the Archive is also mandated to provide meaningful and timely access to its resources. The USGS/EROS Data Center (EDC) must maintain an in-house specialized, scientific and technical core capability to archive and access data. This will allow the Archive to fulfill its mission, meet statutory and policy responsibilities, provide a continuing capability, support research and development, and meet emergency requirements.⁸

IV. Land Remote Sensing Terms of Reference

The Archive's responsibilities include providing access to and disseminating "unenhanced data," not "enhanced" or "value-added" data. However, basic terms like "raw data," "enhanced

⁵ National Space Policy, National Science and Technology Council, Sept. 19, 1996, Intersector Guidelines, para. 3 (a) (iv).

⁶ National Space Policy, National Science and Technology Council, Sept. 19, 1996, Intersector Guidelines, para. 3 (a) (iv).

⁷ National Space Policy, National Science and Technology Council, Sept. 19, 1996, Civil Space Guidelines, para. 6.

⁸ OMB Circular A-76, Supplement, Part 1 C, 3 and 4.

data," "unenhanced data," "information" and others are not used uniformly in the legal and policy literature. In practical terms, how these terms are defined delineate the government's responsibility for maintaining the free flow of information between the government and the public while recognizing the private sector's right to engage in remote sensing commerce free from government competition.

The definitions applicable to land remote sensing data contained in the Policy Act, which established the Archive, are:

1. "Unenhanced" which means "land remote sensing signals or imagery products that are unprocessed or subject only to data preprocessing"⁹

2. "Data Preprocessing"

Includes:

- rectification of system and sensor distortions in land remote sensing data as it is received directly from the satellite in preparation for delivery to a user;
- registration of such data with respect to features of the Earth; and
- calibration of spectral response with respect to such data.¹⁰

Excludes:

- "conclusions, manipulations, or calculations derived from such data, or a combination of such data with other data."

⁹ 15 USC 5602 (13).

¹⁰ 15 USC 5602 (4) A, B and C. Here, the word "and" between subsections B and C is significant. It means that all of the subcategories in A, B and C up to the word "but" may be combined.

The terms, "enhanced" and "value-added" are not defined in the Policy Act. At least one commercial vendor has published its own definition of "unenhanced" which includes geometric and radiometric corrections and extends to "terrain corrected...imagery."¹¹ Whether or not EDC ought to make terrain and precision corrected data available from Landsat 7, was recently addressed at a public workshop for value-added retailers sponsored by EDC.¹² At this time, this question remains unresolved and EDC is still considering its policy for Landsat 7. However, in the different context of accomplishing the Archive mission, EDC does provides access to, and distributes Level 0 and Level 1 data which includes terrain and precision corrected data.

To remove ambiguities and inconsistencies of definition, the following terms of reference are recommended. The terms are based on a basic philosophy which views data levels as follows:

Unenhanced data are numbers proportional in a defined way to the radiance measured by a sensor viewing a specific surface area; a measure of what existed on the Earth system at a point in time, placed geographically and calibrated radiometrically.

The following categories are included in the definition of "unenhanced" land remote sensing data:

1. Raw
Unprocessed, raw data acquired by a land remote sensing system as it views the Earth. Data are stored in the original telemetry format as transmitted from the satellite to the ground station.
2. Level 0R
Reformatted, raw data acquired by the satellite as it views the Earth. Reformatting includes: 1) reordering of the scan data, 2) aligning detectors, etc., and includes data files of ancillary data necessary for processing to higher levels. The data are not radiometrically corrected, the pixels are not resampled, and the pixels are not registered to an earth location.
3. Level 1R
A radiometrically corrected digital image along with the files containing metadata,

¹¹ Space Imaging Eosat,
 http://www.spaceimage.com/home/pubs/tech_papers/enhanced.html

¹² <http://geo.arc.nasa.gov/sge/landsat/vameet/>

calibration parameters, payload correction data, and other sensor information such as mirror scan correction data, a geolocation table, and internal calibration data. The digital image pixels are not resampled or geometrically corrected.

4. Level 1 Systematically Corrected

A radiometrically corrected and geometrically corrected digital image along with metadata, calibration parameters, and a geolocation table. The radiometrically corrected pixels are resampled for geometric correction and registration to an earth location with a geodetic accuracy of 5 to 25 times the sensor ground instantaneous field of view (GIFOV).

5. Level 1 Precision Corrected

Geometric precision correction of the satellite data using ground control points to correlate the spacecraft's predicted position with its actual geodetic position. Geometric precision correction provides an accuracy of +/- one half of the sensor GIFOV, where terrain variation is low.

6. Level 1 Terrain Corrected

Terrain correction includes geometric precision correction using ground control points and are corrected pixel-by-pixel for local terrain displacement errors by utilizing a Digital Terrain Model. The location accuracy is +/- one half of the sensor GIFOV, regardless of terrain variation. The terrain adjustment removes distortion that can result in high relief areas. Provides the highest level of geometric accuracy.

Additional processing of land remote sensing data beyond those defined above would be "value-added" and are not included in the term "unenhanced" land remote sensing data.

V. The Archive's Relationship to the Private Sector

While the Committee recognizes the Archive's mission to produce and distribute Level 0 and Level 1 land remote sensing data as an inherently governmental function, it also recognizes the Archive's statutory responsibility to engage the private sector in its activities in a substantive and meaningful way. Congress found that "commercialization of land remote sensing should remain a long-term goal of United States policy."¹³

The dynamics of the remote sensing industry, including the value-added data enhancement sector, are evolving, and will continue to evolve, dramatically. The National Space Policy establishes the need for EDC to assist in this evolution. It requires government agencies to

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15 USC 5601 (6).

"support the development of U.S. commercial Earth observation capabilities by pursuing technology development programs, including partnerships with industry; ...providing U.S. Government civil data to commercial firms on a nondiscriminatory basis to foster the growth of the 'value-added' data enhancement industry; and making use, as appropriate, of relevant private sector capabilities, data, and information products."¹⁴

To meet these obligations and objectives, it is recommended that EDC enhance its outreach program to the private sector. Examples of how this might be accomplished include establishing a goods and services clearing house for the value-added community; providing information regarding services available from the value-added industry; holding annual meetings with the value-added and user communities; and/or providing a central web site that lists sources for products and services. Particular attention and assistance ought to be paid to smaller and new companies in order to assist the development of a diverse, competitive marketplace. It is particularly noted that, with the advent of *Landsat 7*, data costs to the public are expected to drop dramatically due to returning Landsat operations to the government. EDC should ensure that these lower costs actually result in significant distribution by making the new costs as widely known as possible.

VI. Conclusion

The Archive is a major step in assuring that a permanent record will be kept of the remotely sensed imagery of Earth. The Committee believes that its recommendations in defining the Archive's scope will provide a framework upon which the future expectations of both the public and the private sector may depend.

¹⁴ National Space Policy, National Science and Technology Council, Sept. 19, 1996, Intersector Guidelines, (3) (iii).